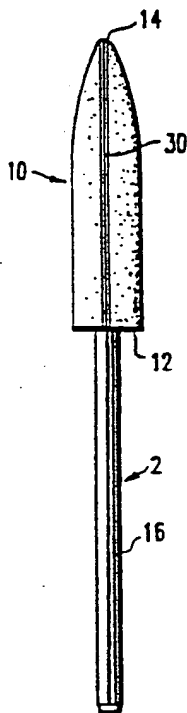


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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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**(54) Title:** INTERDENTAL FOAM BRUSH**(57) Abstract**

An interdental brush is provided with brush members formed of an open cell foam material adhered circumferentially around an elongate plastic stem. The stem extends beyond the brush by a distance sufficient for the stem to form a brush handle. The brush can be molded or laminated onto the stem.

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INTERDENTAL FOAM BRUSH

The present invention relates to interdental brush devices for oral care, and more particularly to a brush of the type in which a disposable brush element is retained on handle by a removable cap member.

A great number of devices have been developed for the cleaning of teeth and massaging of the gums. Typically, they comprise brushes which are retained on a handle by a removable cap member. An example of such a brush and handle may be found in U.S. Patent 4,780,923 (Schultheiss), which is hereby incorporated by reference. In the conventional art such as Schultheiss, the brush is formed by nylon bristles captured between and extending radially from a pair of twisted metal wires which form a stem. The bristles are used to rub or wipe perpendicularly across the gum and tooth surfaces for cleaning the same. A commercial example of such a conventional brush is the interdental brush manufactured by Oral B laboratories of Redwood City, California, which is available in both a cylindrical and a tapered shape.

In the United States, most users become acquainted with interdental brushing after periodontal surgery. Most patients receive specific instructions on use after periodontal surgery, primarily to assure that surgical areas remain free of germs. Periodontists typically recommend a treatment using the existing nylon bristle brush. However, although such brushes satisfactorily perform their cleaning role, many

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patients are reluctant to use the brushes as instructed for fear of pain from the bristles rubbing against their sore mouths. A need therefore exists for an interdental brush which does not have bristles.

5 It is an object of the present invention to provide an interdental brush which can be satisfactorily used for interdental cleaning, but without the use of cleaning bristles.

10 It is a further object of the present invention to provide an interdental brush formed of a foam material.

15 It is yet a further object of the invention to provide an interdental brush which is capable of retaining gels and medicaments for application to a user's mouth during brushing.

It is yet a further object of the invention to provide a method of manufacturing an interdental brush having a brush member formed of an open cell foam material adhered onto an elongate stem.

20 The above, and other, objects are achieved according to the present invention by an interdental brush comprising an elongate stem, and a brush member formed of an open cell foam material adhered circumferentially around the stem. The stem extends  
25 beyond the brush member by a distance sufficient to form a handle.

According to a feature of the invention, the foam material comprises polyurethane or polyethylene, and preferably 60 PPI polyurethane.

30 According to a further feature of the invention, the elongate stem is molded from a plastic which may be a polycarbonate, a nylon, a polyester such as Kodar (an Eastman chemical trademark), or an polyacetal such as Delrin (a Dupont trademark).

35 According to a further feature of the invention, the brush may be made by placing the stem in a mold having a desired shape for the brush member,

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injecting a foam mixture into a mold to form the brushes, and cutting the stem to a desired length. The foam mixture may be a foamable hydrophilic polyurethane prepolymer (a derivative of toluene diisocyanate), a  
5 mixture of polyols and isocyanates, or a foamable elastomer. The stem must have a surface which will bond with the foam composition.

According to yet a further feature of the invention, the brush may be formed by a method including  
10 shaping layers of foam material and laminating two shaped layers of foam material onto a stem.

According to a further feature of the invention, the brush member is tapered towards its end, and is substantially cone shaped.

15 According to a further feature of the invention, the handle has brush members on opposite longitudinal ends thereof.

A more complete appreciation of the invention and many of the attendant advantages thereof will be  
20 readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 is a side view of a stem according to  
25 an embodiment of the invention;

Figure 2 is a side view of a brush according to the embodiment of Figure 1;

Figure 3 is an end view, as seen from the base of the stem, of the brush according to the embodiment of  
30 Figure 1;

Figure 4 is a schematic illustration of a step in a molding operation for producing the brush of Figure 1;

Figure 5 is a side view of a brush according  
35 to another embodiment of the invention; and

Figure 6 shows a variant of the embodiment of Figure 5.

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Preferred embodiments of the invention will now be described with reference to the accompanying drawings, in which the same reference numerals will be used to designate the same, or corresponding, elements throughout the several views.

Referring to Figure 1, there is shown an elongate stem 2. The stem is formed of a plastic material and is preferably molded using a conventional injection molding process. The preferred material for the stem is Delrin (a DuPont trademark), although other materials can be used which provide stiffness with good flexibility. Alternative materials include polycarbonates, nylons, polyesters, or polyacetals.

The preferable polyacetal material is Delrin II, 500 grade.

A leading end 4 of the stem is preferably spherical while a base end 6 of the stem is preferably chamfered. The stem is preferably formed with an annular boss 8 at a mid-portion thereof, i.e., positioned to be completely enclosed in the foam and positioned to be nearer the base end 12 thereof.

A brush 10 is adhered onto the stem 2, as seen in Figure 2. The term "adhered", as used herein, is defined to connote that the foam be chemically or physically bonded to at least a portion of the stem surface so that the foam will remain in place on (not sliding along) the stem surface during use. Chemically inert or non-reactive smooth stem surfaces can be prepared to facilitate chemical and/or physical bonding with the foam by physical abrasion, treatment to provide chemically reactive groups on the surface, or combinations thereof. Surface treatments which increase chemical reactivity with polyurethane foams, for example, include treatments with corona discharge, chemical oxidants, and gas plasmas.

The brush is formed of an open cell foam material, the open cell nature of the material assuring

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that the brush surface has cavities to receive and retain solids which are removed from gum, gingiva and tooth surfaces during rubbing application of the foam to these surfaces, and the foam material will absorb water or other substances, and will completely dry after use. The preferred material for the foam is a soft, at least 80 PPI polyurethane, although smaller or larger cell sizes can be used depending upon whether an abrasive feel or a smooth feel is required, or larger or smaller surface cavities are required. Other possible foam materials include 10, 20, 30 or 60 PPI polyurethane or HZ polyethylene.

As seen in Figure 2, the brush 10 has a base end 12 at a mid portion of the stem, which base end 12 is positioned closer to the base end 6 of the stem than is the boss 8, so that the brush surrounds and covers the boss. The brush extends to a distal end 14 thereof which covers the leading end 4 of the stem. In the preferred embodiment, the brush is tapered and is substantially cone or bullet shaped. However, it may be appreciated that other shapes are possible, including cone shapes having circumferential corrugations, bullet shapes having circumferential corrugations, or any of the above shapes having longitudinal ribs.

The soft appearing foam will have greater aesthetic appeal to the user, who will therefore be less reluctant to use the brush as instructed to remove plaque from interproximal areas and below the gum line.

A further advantage of the open cell foam construction of the brush of the present invention is that it is possible to retain therein gels or other medicaments which are to be applied to the tooth and gum surfaces during use.

The brush according to the present invention may be used in the same manner as conventional interdental brushes. Prior to use, the tail end 16 of the stem which extends beyond the brush can be inserted

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and clamped into a conventional handle such as that of U.S. Patent 4,780,923. Subsequently, the brush is applied to the interdental area. The boss 8 forms a stabilizing support for helping to maintain the longitudinal position of the brush on the stem during use. Moreover, the spherical tip of the stem eliminates sharp edges which could pierce the brush or be painful to a user.

The brush can be molded onto the stem in the manner shown in Figure 4. There, a stem precursor 20, which has an extended base end, is positioned between two mold halves 22 and 24, which are subsequently closed. The mold halves have recesses 26 and 28 which together define a mold volume having a shape corresponding to the desired shape of the brush. To form the brush, the foam material may be dispensed into mold cavities using a dispensing machine with distributing nozzles before the closing of the mold; or the foam material may be injected in a conventional manner following the closing of the mold. The base end of the stem precursor is then cut to appropriate length to form the stem.

Alternatively, the brush may be formed by two foam layers which are cut to the desired shape and laminated onto the stem. Lamination can be via a known adhesive, or by flame adhesion. In this case, the joint lines 30 of the two laminated halves will be visible as recesses.

Non-limiting dimensions for a preferred embodiment of the brush, in inches, are:

stem length 1.163,  
stem diameter .035,  
brush length .50,  
maximum brush diameter .125,  
boss axial length 0.050,  
boss maximum diameter 0.10,



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distance from leading end of stem to boss  
0.39.

Another embodiment, which may be referred to as a "toothpick", is shown in Figure 5. There, the stem  
5 is not clamped onto a separate handle for use. Instead, the stem 200 is radially enlarged at a central portion thereof to form a handle 202, so that the brush can be handled like a toothpick and used in a manner similar to a toothpick. In the embodiment of Figure 5, the handle  
10 202 of the stem 200 is hexagonal in section. The handle 202 terminates at conical ends 204 which taper at a 30° angle to merge with the smaller diameter portion 206. Portion 206 of the stem is identical to the part of the stem of the first embodiment which is covered by the  
15 brush member. Although not shown in Figure 5, a brush member is adhered onto the portion 206 in the same way as described above.

As may be seen from Figure 5, the opposite longitudinal ends of the stem 200 of this embodiment are  
20 identical, so that two brush members are formed at longitudinally opposite ends thereof. The ends may be alternated during use in the same way that one might alternate the ends of a toothpick.

In a non-limiting embodiment, the portion 206  
25 of the stem has a diameter of 0.30 inches while the hexagonal handle 202 has a maximum diameter of 0.125 inches and the stem has an overall length of 2.75 inches.

The variant of Figure 6 is identical to that  
30 of Figure 5, except that the handle 302 of the stem 300 is circular and has conical ends 304 which taper at an angle of 15°.

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C L A I M S

1. An interdental brush comprising:  
an elongate stem; and  
a brush member formed of an open cell foam material adhered circumferentially around said stem, wherein said stem extends beyond said brush member by a sufficient distance to form a brush handle, and wherein said stem includes an annular boss covered by said brush member.
2. The interdental brush of claim 1, wherein said foam material comprises one from the group consisting of polyurethane and polyethylene.
3. The interdental brush of claim 1, wherein said foam material comprises a 60 PPI polyurethane.
4. The interdental brush of claim 1, wherein said stem is formed of a molded plastic.
5. The interdental brush of claim 4, wherein said molded plastic is a member selected from the group consisting of polycarbonates, nylons, polyesters, and polyacetals.
6. The interdental brush of claim 1, wherein said brush member extends from a mid-portion of said stem to a leading end thereof, said leading end being spherical.
7. The interdental brush of claim 1, wherein said brush member is tapered toward a distal end of said stem.
8. The interdental brush of claim 7, wherein said brush member is substantially cone shaped.
9. The interdental brush of claim 1, including two of said brush members formed on longitudinally opposite ends of said stem.
10. The interdental brush of claim 9, wherein a center portion of said stem, between said brush members, is radially enlarged to form a handle, thereby facilitating manipulation of the brush during use.
11. A method of making an interdental brush having an elongate stem and brush members formed of an open cell foam

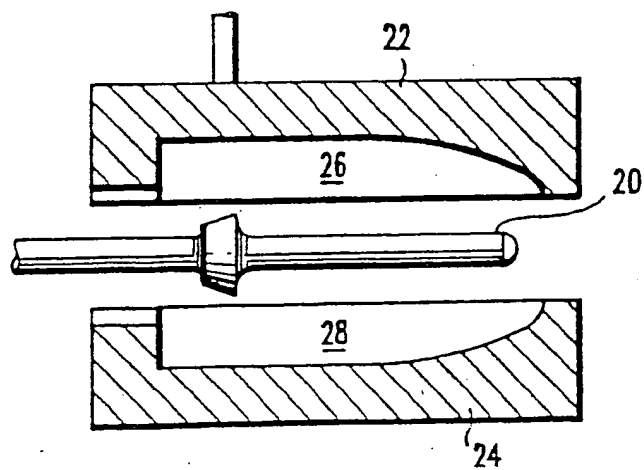
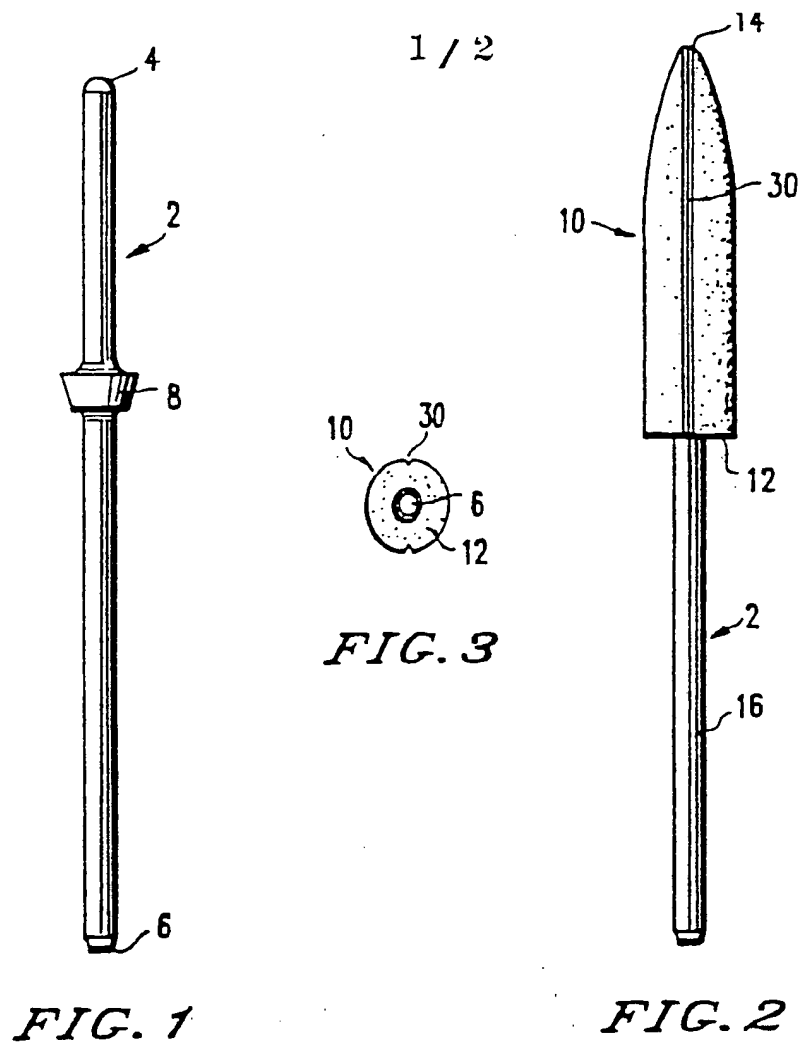
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material adhered circumferentially around said stem,  
comprising the steps of:

placing the stem in a mold having a desired shape  
for the brush members;  
injecting the foam material into the mold; and  
cutting the stem to a desired length.

12. A method of making an interdental brush having an  
elongate stem and brush members formed of an open cell foam  
material adhered circumferentially around said stem,  
comprising the steps of:

shaping layers of foam material; and  
for each brush member, laminating two shaped  
layers of the foam material onto the stem.



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FIG. 5

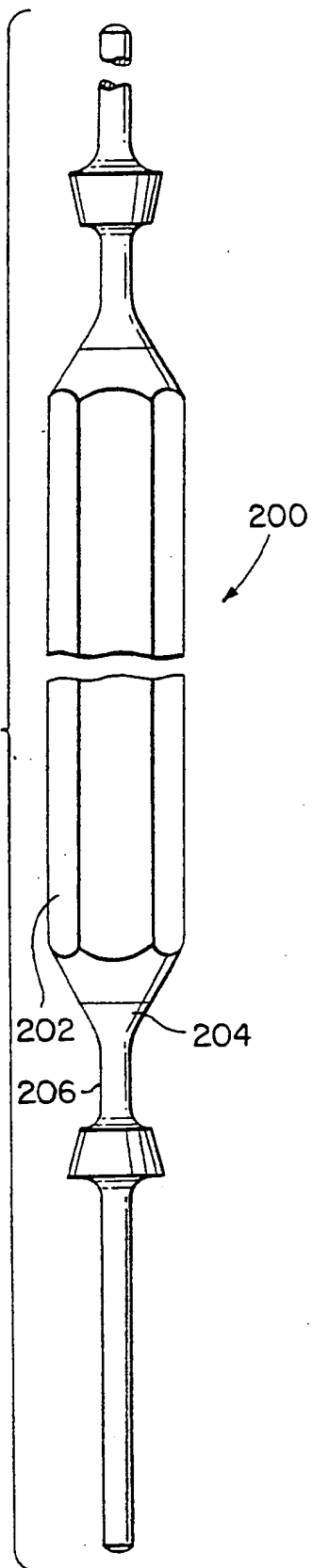
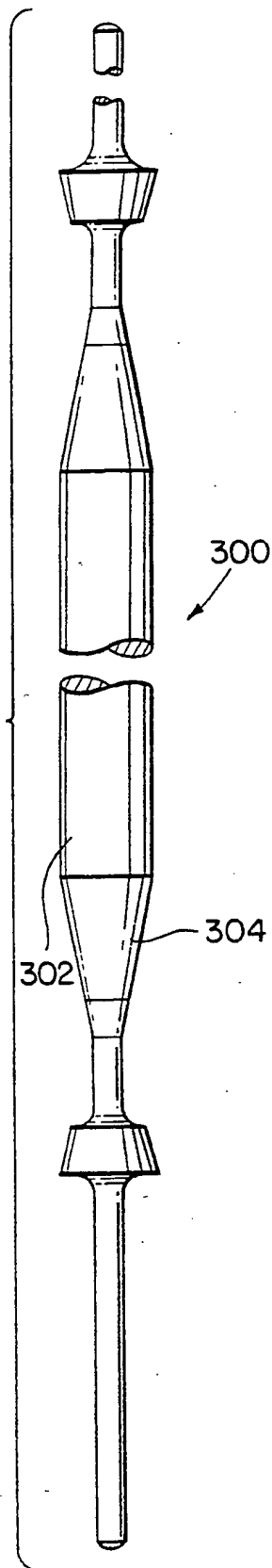


FIG. 6



# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/06715

## CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) and to both National Classification and IPC

IPC(5): A61M 37/00

US CL : 15/244.1

### FIELDS SEARCHED

Minimum Documentation Searched

U.S.

15/244.1, 111, 22.1, 167.1  
604/1, 264/DIG. 83, 54

Classification Symbols

Documentation Searched other than Minimum Documentation  
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## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of Document with indication, where appropriate, of the relevant passages | Relevant to Claim No. 3 |
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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

Date of Mailing of this International Search Report

07 NOVEMBER 1991

25 NOV 1991

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I  
PATRICK F. BRINSON